

Academic Procrastination: Present Bias and Lecture Preparations

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Abstract

In this thesis I study academic procrastination, and try to look at the phenomenon from various angles and approaches. I start out reviewing the literature on the subject, from both an economic and psychological perspective. While psychologists mostly emphasize the various personality traits and individual differences of the people who procrastinate, economists have focused their attention to time preference, and how procrastinators might discount the future differently from others. In particular, models of present bias seem to fit both experimental and real world data, as well as our intuition, better than models using standard exponential discounting.

In Part II of the thesis, I discuss and analyze the results from two surveys performed on economics students at the University of Oslo. Procrastination is inherently difficult to identify and measure, and therefore I rather attempt to measure how well prepared the students are for the two lectures where they are surveyed. Before the first lecture, the students had the opportunity to complete some online preparation exercises, and the availability of these creates an incentive mechanism that may induce procrastinating students to prepare, without affecting the behavior of exponentially discounting students much. I formally describe the decision process of the students using a model of present bias, and find that the level of preparations is likely to be affected by both the degree of present bias and the students' awareness of their own self-control problems. And indeed, the reported levels of preparations are significantly higher for the lecture where the preparation exercises were available. I then estimate a multiple regression model in Stata, with the difference in the levels of preparations between the two lectures where the surveys were held as the dependent variable. As explanatory variables, I use the survey responses to various statements regarding the study habits and attitudes of the students, as well as some more standard, demographic variables. While much of the variation in the difference in levels of preparation can be explained by how busy the students are (e.g., if they have a job) and measures for how they value lecture preparations relative to other educational activities, I find a significant effect that may imply that for students who prepare less than they want, the preparation exercises may have worked as a remedy for procrastination.

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I am solely responsible for all errors, typos and omissions.

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«Time you enjoy wasting is not wasted time.»

John Lennon

1 Introduction

It is almost needless to point out that we all procrastinate from time to time. While you are reading this, there are probably plenty of other things you know you should do, and after you have read this, there might be other things you wish you had done instead. However, all activities suppress some other activities, and simply not doing everything cannot be thought of as procrastination. The John Lennon-quote above suggests an important limitation: delaying a task is not equivalent to procrastination. What matter are the reasons (or lack thereof) for the delay.

References to procrastination can be traced back to ancient times, and throughout history, it has quite consistently been viewed as a problematic and harmful kind of behavior (Steel, 2007). Despite being a phenomenon that has engaged researchers for a long time, there seems to be a lack of general agreement and consensus regarding *why* we procrastinate. While psychologists mostly focus on the various personality traits of the people that can be classified as procrastinators, economists who study the subject typically emphasize the importance of time preference. With the increasing prevalence of behavioral economics during the last 20-30 years, new models have been developed that better can explain the observed behavior. In particular, the models of present bias, developed by Ted O'Donoghue and Matthew Rabin, give an elegant, tractable and intuitive framework for studying procrastination and related phenomena¹.

One thing that most researchers do agree on, however, is that students are notorious procrastinators. This seems a well established fact, both as a casual observation, and through

¹O'Donoghue and Rabin (2006) mention a few topics that might be better understood by models of present bias rather than standard discounting: “general savings rates, credit-card borrowing, cigarette consumption, welfare enrollment, procrastination in personal investment, unemployment and procrastination in employment search, purchase quantities under non-linear pricing for ‘virtue’ vs. ‘vice’ products, the effects of payday timing on monthly consumption patterns, food stamps, the effects of coupons and rebates on demand for products, organizational incentives, retirement timing, finishing school, returning to school for G.E.Ds, unsafe sex and AIDS and pregnancy, procrastination in seeking medical attention, compliance with medical prescriptions, alcohol consumption, unhealthy eating, exercise, obesity, procrastination in research, and seeing too few Johnny Depp movies.”

empirical research. Ellis and Knaus (1977) estimate that no less than 95% of American college students are procrastinating to some extent. Solomon and Rothblum (1984) find that 46% nearly always or always procrastinate when writing a term paper. Furthermore, 23.7% reported that they perceive their procrastination habits as a problem, and 65% wanted to reduce their tendency to put off work. These numbers can indeed be interpreted as an indicator of procrastination being a self-control problem, rather than a planned and intended way of behavior.

There are several reasons why students might be extra prone to procrastination. First of all, the student life is exceptionally full of deadlines. But these deadlines may not necessarily be strictly binding. Hence, there is often a cost associated with missing a deadline, but this cost need not be of the kind that induces all students to comply to all deadlines. In addition, the very construction of academic activities is organized in such a way that make the rewards from providing effort inherently abstract, and the total benefits from reading, writing term papers and getting good grades may be spread out over the entire lifetime. Student life is also typically full of tempting activities, giving instant gratification, such as going to parties, hang out in a parks or take a few days off to go to the mountains. Students might also be used to up until recently having responsible third parties in their lives, such as parents and teachers, that closely monitor their activities, and intervene when they observe procrastination. When a student moves out of his parents' house and the university professors are not as persistent at reminding the student to study as the high school teachers were, then clearly, procrastination can be more likely.

The remainder of this thesis is organized as follows: In Part I, I first define the facet of procrastination I intend to analyze, and discuss some other interpretations and definitions. Section 3 reviews the economic literature on the subject, and Section 4 gives an overview of the psychological counterpart and discusses a recent attempt to unify the many divergent and disjoint studies of procrastination made by psychologists. In Part II, I discuss and analyze the survey that was conducted. Section 6 provides a formal model describing the decision problem of students that participated, while Section 7 and 8 discuss the results of the survey. Section 9 concludes.

Part I

Literature review

2 How to define procrastination

The word “procrastination” is roughly derived from the Latin verb *procrastinare*, from *pro* (“in favor of”) and *crastinus* (“tomorrow”). Hence, the etymological origin of the term suggests that to procrastinate means “to be in favor of tomorrow”. In accordance with this definition, most modern day use of the word generally refers to the postponement and delay of tasks.

At any point in time, there is an innumerable amount of things one potentially could do. Simply not doing all of these things, cannot be thought of as a result of procrastination. In order to identify procrastination, it seems evident that we should restrict our attention to tasks and duties that the prospective procrastinator at some point regards as worthwhile to finish. Another issue is that in an uncertain world, new information and events can always change our initial plans. If the future is sufficiently uncertain, it can very well be optimal to defer actions and decisions to a later time, where one aims at being more well-informed. These two limitations suggest that procrastination occurs when a task is being postponed *and*

- both from a prior perspective, and in retrospect, the decision maker does not want to postpone
- there are no external forces that induce the decision maker to postpone.

This is not a definition that is meant to encompass all facets of procrastination, but I view it as a fairly accurate description of the phenomenon, especially among students. In particular, this approach is the one most closely linked to how procrastination has been studied by economists. Most of the economic literature consider procrastination as a self-control problem, where the decision maker suffers from time inconsistency and irrational expectations about his future preferences (see e.g. Akerlof, 1991; O’Donoghue and Rabin, 2000). This induces a gap between his intentions and actions, and he can end up in a situation where he finishes a given task both later than he *thought* he would, and later than he *wish* he would (Asheim, 2007).

However, definitions of procrastination differ widely within the academic literature, and the researcher's own personal experience with the phenomenon seems to affect how he or she defines it. Fischer (1999b) views procrastination as behavior where most, or all of the work required to complete a task is done at the eleventh hour. From this perspective, procrastinators are simply characterized by not distributing their workload evenly, and finishing the majority of it close to a given deadline. This interpretation does not differentiate between cases where there are good reasons to postpone a task, and cases where the delay is actually caused by procrastination, as defined above.

Other researchers (e.g., Chu and Choi (2005)) suggest that there may be different types of procrastinators, and that some types need not suffer from their behavior. In particular, these types may actively postpone work, because they perform better under high pressure and relish the challenge of completing a task in the last minute. There may be a fine line here, between *believing* that one performs better under pressure, and actually doing so. Falsely expecting to do good work under high pressure, and consequently either missing a deadline or completing a task of inferior quality, can well be described as procrastination under the definition I suggested earlier. But the type of procrastinator that Chu and Choi (2005) refer to, correctly predicts that completing tasks late is optimal for him, and thus he completes tasks late. And again, simply doing something later than the earliest possible moment to do it, cannot immediately be thought of as a result of procrastination within the framework I intend to use in this thesis.

3 Procrastination and economics

The number of economic studies of procrastination is relatively scarce, compared to the psychological counterpart. Fischer (1999b) notes that the dichotomy presumably exists due to the irrational nature of procrastinatory behavior - and economists tend to favor studying rational agents, while the opposite can roughly be said about psychologists. However, with the emergence and rising prevalence of behavioral economics during the last 20-30 years, economic studies of procrastination and related topics seem to be on the rise.

3.1 Intertemporal choice

In order to understand why people choose to postpone one action in favor of another, it seems evident that one needs to appreciate how costs and rewards associated with those actions are valued, when incurred at different points in time. The discounted utility (DU) model proposed by Samuelson (1937) was quickly accepted and endorsed as a descriptively valid representation of actual, intertemporal human behavior, and has since its inception been widely used as a standard for economic analysis, both in research and in governmental decision making (Frederick et al., 2002)². The main feature of the DU model is the idea that all psychological concerns and motives that affect intertemporal choice can be condensed into a single parameter, namely the discount rate. These preferences can be represented by the following intertemporal utility function (in discrete time):

$$U^t(u_t, u_{t+1}, \dots, u_T) = \sum_{\tau=0}^{T-t} D(\tau) u_{t+\tau}$$

where $D(\tau) = (\frac{1}{1+\rho})^\tau = \delta^\tau$ is the discount function and ρ the discount rate. Suppose $\rho = \frac{1}{4}$, which implies discount factor $\delta = \frac{4}{5}$. If we let one period, t , correspond to one day, a person with this utility function values utility tomorrow only 80% as much as he values utility today, or put differently, he is willing to forgo a gain in utility tomorrow for a gain today that is only 80% as large. With this functional form, $D(\tau)$ is exponentially decreasing in τ , and thus the DU model is commonly associated with exponential discounting. The typical assumptions that the instantaneous utility function $u_{t+\tau}$ is concave and $\rho > 0$ creates a tradeoff for the agent: diminishing marginal utility induces the agent to smooth consumption across time, while a positive time preference makes him somewhat impatient and wanting to

²However, Samuelson himself did not believe that the DU model was neither descriptively, nor normatively plausible.

consume in the present. The assumption that ρ is constant for all t creates *time consistent* preferences. The marginal rate of substitution between consumption at two points in time depend only on the distance between the points - not on how far away they are from now. If you prefer 80\$ today over 100\$ tomorrow, you also prefer 80\$ dollars in one month over 100\$ in one month and a day. Fischer (1999b) studies academic procrastination under these preferences. She considers a task that requires many units of effort over a finite amount of time, such as writing a term paper. She finds that the model can explain behavior where the workload increases rapidly when the deadline approaches, but quantitatively it requires an unreasonably high discount rate. In addition, as discussed in Section 2, some of the main characteristics of procrastination - namely, that it is subjectively undesirable and irrational - cannot be explained with time consistent preferences.

Strotz (1956) may have been the first economist to consider alternatives to exponential discounting (Frederick et al., 2002). He shows that for any other discount function than an exponential, the agent will display *time inconsistent* preferences. Strotz asks “*If he [the agent] is free to reconsider his [optimal] plan at later dates, will he abide by it or disobey it - even though his original expectations of future desires and means of consumption are verified?*”. He claims that generally, the plan will *not* be obeyed, and suggests that a discount rate that is decreasing over time would be more descriptively accurate. Both experimental and anecdotal evidence support this claim. In both lab and field experiments, many subjects non-surprisingly exhibit a preference for sooner-smaller rewards over larger-later rewards, but, inconsistent with exponential discounting, the implied discount rates seem to diminish the longer the time horizon becomes. Several studies have tried to fit such data to discount functions, and a hyperbolic functional form seems to be a far better fit than the exponential (Frederick et al., 2002).

3.2 Hyperbolic discounting, present bias and procrastination

The first explicit account of procrastination in the economic literature is due to Akerlof (1991). He introduces the notion of “salient costs”, meaning that costs (or benefits) today are more “vivid” than any future costs. This leads to procrastination when individuals do not foresee that when tomorrow comes, a cost that led them to delay an action today, will then be just as “vivid”, and thus lead to further postponement.

Ted O’Donoghue and Matthew Rabin present, through a series of articles (see e.g. O’Donoghue and Rabin (1999a,b, 2001)), possibly the most influential and prominent research on procrastination within the economic framework. They generalize Akerlof’s concept of salience

costs by applying a simple and tractable version of hyperbolic discounting, dubbed quasi-hyperbolic discounting, or simply (β, δ) -preferences, which was first proposed by Phelps and Pollak (1968) to study intergenerational altruism. The combination of impatience and time inconsistency gives what they call present bias. When the agent considers a tradeoff between two future points in time, the earliest point will be given relatively more weight as it gets closer. The intertemporal utility function they propose takes the form

$$U^t(u_t, u_{t+1}, \dots, u_T) = u_t + \beta \sum_{\tau=1}^{T-t} \delta^\tau u_{t+\tau}, \quad 0 < \beta < 1$$

The implied discount function is here given by $D(\tau) = \beta\delta^\tau$. For an agent in period t , the discount factor between now and $t+1$ is $\beta\delta$, but between any two future, adjacent periods, it is $\delta \geq \beta\delta$ for $\delta \in [0, 1]$, as seen from period t . In terms of discount rates, the discount rate between now and the next period is $\frac{1-\beta\delta}{\beta\delta}$, while between any two future, adjacent periods it is $\frac{1-\delta}{\delta} \leq \frac{1-\beta\delta}{\beta\delta}$. This structure only applies, however, to the agent at time t . At time $t+1$, the discount factor between “the new now” and $t+2$ is again $\beta\delta$, although from the point of view of period t , it was δ . This creates a conflict between the “selves” at different times, or formally, the preferences are time inconsistent. Setting $\beta = 1$ yields the standard exponential discounting case, hence, exponential discounting is in fact a special case of (β, δ) -discounting.

What drives procrastination in this model is not only the preferences in themselves, but also the agent’s beliefs about his preferences in the future and the timing of costs and rewards. Sophisticated agents are fully aware of their self-control problems³, and correctly predict their future behavior. Naive individuals, on the other hand, falsely believe that they will actually behave in the future as they currently want their future selves to behave (i.e. as exponential discounters). This creates procrastination when costs are immediate, and rewards belong to the future. As in Akerlof’s model, naifs will constantly put off costly tasks, because they wrongly presume that they will do the task in the future. Sophisticates might finish tasks with immediate costs later than exponential discounters do, but do not procrastinate in the sense that they *know* when they will complete a task if they delay it now - and they do the task now, if the utility from doing so is larger than from doing it in the future. This creates a demand for commitment - unlike naifs or exponential discounters, a sophisticated agent would be willing to pay a cost in order to restrict future choices. Ariely and Wertenbroch

³I will use the terms “self-control problems”, “time inconsistency” and “present bias” somewhat interchangeably, although they do not mean the same thing, strictly speaking. Present bias is in some sense a special case of time inconsistency, while self-control problems refers to the (in)ability to control one’s impulses, feelings, actions, and so on, and is often analyzed by economists applying precisely present bias and time inconsistency. The point is, when I describe an agent suffering from either self-control problems, from present bias or from time inconsistency, it will generally mean the same thing.

(2002) find that students are willing to impose costly deadlines on themselves (costly in the sense that they lower flexibility and, if not met, would lead to penalties) in order to combat procrastination. However, they argue that these self-imposed deadlines are not optimally set, and suggest that people are only imperfectly able to identify their own self-control problems. O'Donoghue and Rabin (2001) investigate this notion, and propose an alternative to the somewhat unreasonable assumption that people are either completely naive or completely sophisticated. They allow the agents to be *partially* naive - that is, they let $\hat{\beta}$ be a person's *belief* about his future self-control problem. Sophisticates have, by definition, $\hat{\beta} = \beta$, while naifs have belief $\hat{\beta} = 1$. On the other hand, partially naive agents have $\hat{\beta} \in (\beta, 1)$. Intuitively, any degree of partial naivete is sufficient to induce procrastination - but procrastination is less likely to occur for $\hat{\beta}$ close to the true β , than for large deviations.

In the same paper, O'Donoghue and Rabin also explore a phenomenon that is of particular relevance for academic procrastination. Usually, a student does not only have to decide *when* to finish a task, but he must also choose *which* task to complete. For instance, writing a term paper, or a master thesis, requires a number of smaller subtasks, such as reading articles and analyzing data. Most students take multiple courses each semester, and have to juggle their preparations in a weighted fashion in order to be well prepared for the exams. O'Donoghue and Rabin get a somewhat puzzling result when they consider a time inconsistent and partially naive person who chooses from a menu of different tasks. They find that (a) providing the agent with additional options may exacerbate procrastination, and (b) that he might procrastinate more when pursuing important tasks, than unimportant ones. The intuition is that it is the long run net benefits that influence whether he *plans* to do a task, while it is the immediate costs and benefits that determine whether he actually does it. For (a), if the new task has sufficiently high long run net benefits, he will prefer doing the new one. But if it also entails higher immediate costs, he might now procrastinate on both tasks, although he would have done the former when the new one was not available. This behavior violates the weak axiom of revealed preferences. Additional and unchosen alternatives should not change choice among existing alternatives. For (b), increasing the importance of a task, could also increase the ambitions of the agent and the effort he plans to incur (i.e., the immediate costs), and procrastination can be more likely.

3.3 Numerical example

In order to clarify the intuition on how (β, δ) -preferences and procrastination is related, let us consider a practical and numerical example, inspired by O'Donoghue and Rabin (1999a).

Assume that a student has a term paper due on Monday morning. Finishing the paper requires a full day's work and gives him future benefit B , and this reward is independent of when the task is finished, as long as it is done before the deadline. Let us also assume that B is sufficiently large, so that missing the deadline is not an option.

On Wednesday, the week before deadline, he considers whether he should do it on Thursday, Friday, Saturday or Sunday. His problem is that he is invited to parties every day, except Sunday. He does not want to miss any of the parties, but he prefers missing the party on Thursday to the party on Friday, and to miss the party on Friday to the party on Saturday. However, what he fears the most is to be forced to finish the task on Sunday, because he knows he will be extremely tired from partying three days in a row. In accordance with this, let the cost schedule be $\mathbf{c} = (3, 5, 8, 13)$, where $c_1 = 3$ is the cost incurred when doing the task on Thursday, and so on. These costs reflect both the disutility from exerting effort and the opportunity cost of missing a party.

Suppose, for simplicity, that there is no long run discounting, i.e., $\delta = 1$, and that the instantaneous utility function, u_t , is linear ⁴. As a benchmark, let us first consider an exponential discounter. That is, he has $\beta = 1$. His decision is trivial in this case. There is no discounting, and he finishes the paper on the day that maximizes $B - c_t$, which is on Thursday, as he simply chooses to finish the paper when his cost is lowest. In terms of a game theoretic strategy, his complete contingency plan will be $\mathbf{s}^e = (\text{write}, \text{write}, \text{write}, \text{write})$, since we assumed that the paper is worthwhile to finish within the deadline. Now, let the student be present biased, with $\beta = \frac{1}{2}$:

- If he is sophisticated, we can apply backward induction to describe his behavior. On Sunday, he has to finish the paper hung over, at a cost of 13. On Saturday, he will want to postpone the work until Sunday, as his cost is $8 > 13\beta = 6.5$. On Friday, he correctly predicts that if he does not do it now, he will procrastinate until Sunday. Since $5 < 13\beta = 6.5$, he decides to drop the party and finish the paper. On Thursday, he knows that if he postpones the task, he will do it on Friday. Since $3 > 5\beta = 2.5$, he will party on Thursday. His strategy is then $\mathbf{s}^s = (\text{party}, \text{write}, \text{party}, \text{write})$. What we can deduce here, is that on Wednesday, the sophisticated student would actually be willing to pay in order to commit himself to finish the paper on Thursday. Seen from Wednesday, the difference in net benefits from doing it on Thursday and Wednesday is $\beta(B - 3) - \beta(B - 5) = 2\beta = 1$. Hence, the sophisticated agent would be willing to pay up to a cost of 1 in order to somehow commit himself to write on Thursday.

⁴These assumptions can be justified by the fact that we are looking at a fairly short timespan and that utility is often assumed to be approximately linear over small amounts.

- If he is naive, on Wednesday he plans to finish the paper on Thursday, as a time consistent student would. But come Thursday, his cost from doing it is $3 > 5\beta = 2.5$, so he procrastinates and goes to the party, believing he will do it on Friday instead. However, on Friday his cost is $5 > 8\beta = 4$, and again he parties, and again he believes that he will do it the next day. Then, on Saturday, his cost from missing the party is $8 > 13\beta = 6.5$, inducing him to procrastinate yet another day. Finally, on Sunday he has to finish the paper with a throbbing headache, at a cost of 13, the worst possible outcome. His strategy is then described by $\mathbf{s}^n = (\text{party}, \text{party}, \text{party}, \text{write})$. Even though he realizes that he has obtained the worst outcome, the naive will, unlike the sophisticate, never be willing to pay in order to commit to write on Thursday, or any day for that matter, since he always believes that he will do it the next day.

3.4 Other theories

3.4.1 Dual-self models

While models of present bias and hyperbolic discounting are the most prominent ones in economic research on procrastination, there exist alternative explanations of the phenomenon. Thaler and Shefrin (1981), and later Fudenberg and Levine (2006), model self-control problems by what they call a “dual self” approach. They suggest that the agent’s mind in each period consists of two distinct “selves”; a farsighted planner, and a myopic doer. The planner is concerned with lifetime utility, while the sequence of doers only seek to maximize utility for the periods in which they exist. If the preferences of the long-run and short-run selves differ, the planner will consider paying a cost in order to constrain the actions of the doer. This is analogous to the sophisticated quasi-hyperbolic discounter’s demand for commitment in the (β, δ) -model⁵.

Recent insights from neuroeconomics have given further plausibility to the relevance of the dual self approach. McClure et al. (2004) demonstrate that there are indeed two separate parts of the brain that are activated when engaged in intertemporal decision making. In particular, they find that preference for immediate rewards is driven by the limbic system, while the prefrontal cortex works as a mediator, able to appreciate more abstract, future rewards. They dub these areas the β and δ -parts of the the brain, respectively, with reference to (β, δ) -preferences.

⁵The (β, δ) -models can be understood as “multi-self” models, with an *intertemporal* conflict between temporal selves. The dual self models, on the other hand, considers an *intratemporal* conflict of interest (Asheim, 2007).

3.4.2 Anticipatory utility

Loewenstein (1987) studies the effects of anticipation on utility. His notion is that anticipation of future consumption affects utility, and thus behavior, today. This can lead to “reverse” time inconsistency, and in particular to an acceleration of the completion of undesirable tasks, in order to “get it over with”. This suggests that anticipation can mitigate procrastination. However, this is contingent on the task being one that eventually has to be finished. In a more realistic setting, where a person has different tasks that he *should*, but not necessarily *needs* to finish, one could argue that anticipating the disutility of doing a task could lead to procrastination. Albeit unrelated to economic theory, psychologists Lyons and Beilock (2012) find that for people with a high level of math anxiety, the very anticipation of doing math triggers activity in the brain regions related to pain and threat detection. The surprising finding, however, is that these relations were not observed while the subjects actually were doing math, suggesting that the disutility of anticipating a dreaded event actually can outweigh the true disutility of experiencing the event.

3.4.3 Differential discounting

In addition to being impatient and assigning more weight to the present than the future, agents may also assign different discount rates to different goods and events, even if they occur at the same time. We can imagine that utility from leisure (or the disutility of writing a term paper) is discounted more heavily than the rewards (penalties) of (not) completing that paper, regardless of the timing of costs and benefits. In some sense, (β, δ) -preferences can be described as differential discounting, where the utility of the present versus tomorrow is discounted differently than utility in all future time periods. Fischer (1999a) studies procrastination under both differential and quasi-hyperbolic discounting. She finds (when considering sophisticates doing a task that requires repeated efforts) that while both types of discounters wish they could get more work done in the future, the differential discounter’s emphasis on leisure makes him want to accumulate more of the workload close to the deadline. This compares to the quasi-hyperbolic discounter, who wants to behave like an exponential discounter, and smooth effort and leisure more evenly over time.

4 Procrastination and psychology

In an ambitious meta-analytic study, Steel (2007) reviews more than 500 publications on procrastination. He finds theories and evidence suggesting a relationship between procrastination and almost every thinkable personality trait; from perfectionism to rebelliousness, from extraversion to death anxiety. Although clearly a hot topic among psychologists, there seems to be a lack of consensus concerning both the empirical and theoretical framework for studying procrastination in the psychological literature ⁶. Steel and König (2006) try to overcome these discrepancies by formulating what they call temporal motivation theory (TMT). Their goal is to integrate different psychological insights on intertemporal choice, as well as contributions from behavioral economics (e.g. hyperbolic discounting). I will discuss TMT more thoroughly in Section 4.2.

4.1 Causes of procrastination

Most of the literature focus on the personality traits and characteristics of the people that procrastinate, rather than the attributes of the tasks that are being put off (Schiming, 2012). In the subset of the research that also considers the task characteristics, the unsurprising conclusion is that students, and people in general, procrastinate tasks that they find aversive and tedious (Milgram et al., 1988; Solomon and Rothblum, 1984). However, the degree of aversiveness of a given task is necessarily a subjective measure, as some people find mathematics more rewarding than, say, exercising, and vice versa. Steel (2007) recognizes, as in the (β, δ) -literature, that what is undoubtedly an important issue in understanding why some tasks are being procrastinated, is the timing of costs and rewards associated with the task.

In the following, I will discuss the various personality traits that are most frequently associated with procrastination in the psychological literature. To begin with, and in relation to the subjective nature of task aversiveness, one suggestion is that procrastinators are more prone to boredom than others (Ferrari, 2000). They simply find more of their duties and chores aversive than do most people, which makes both initiation and completion of tasks a burdensome process. Impulsiveness and distractibility is likely related to both procrastination and boredom proneness (Ainslie, 1975; Blatt and Quinlan, 1967). Impulsive people might struggle to follow up on their long term goals, and rather indulge in instant pleasures, while being easily distracted is of course detrimental for completing tasks that require effort over time.

⁶Steel (2007) notes, however, that the diversity is not necessarily an evil: “*different attempts by researchers to refine understanding can be complementary, rather than contradictory*”.

These traits can in turn be thought of as facets of extraversion (Steel, 2007). Extraverted people are typically described as outgoing, social and talkative. Intuitively, putting a high value on social interaction with friends might be incompatible with academic performance (Strongman and Burt, 2000), and could cause a role conflict between work and social relationships that facilitates procrastination (Senécal et al., 2003). However, extraverts are also positive, optimistic and energetic - characteristics that might affect procrastination in the opposite direction. Hence, the complete relationship between extraversion and procrastination is somewhat ambiguous (Steel, 2007).

Steel (2007) also suggests another intuitively reasonable explanation of procrastination, which might be of particular relevance for students: the level of achievement motivation. More motivated students might experience that performing well is rewarding in itself, which could make academic tasks less aversive. Steel notes that achievement motivation is not limited to intrinsic motivation, but can also contain extrinsic elements, such as good academic results and high wages.

Moving on, psychologists also find correlation between personality traits and procrastination that seem counterintuitive (at least to economists). Fear of failure and perfectionism (see e.g. Jadidi et al. (2011); Solomon and Rothblum (1984)) are two such attributes. On one hand, perfectionism in the sense that one always seeks to do better and set high standards is likely a valuable virtue for most students. On the other, excessive or dysfunctional perfectionism might lead a student to avoid tasks and situations where their unreasonably high standards seem unlikely to be met. The same logic applies to the fear of failure. If the student strongly fears that he will fail on some task, exerting more effort might only increase disappointment and hopelessness - and procrastination may take place. This is in some sense related to self-handicapping, a strategy aimed at avoiding loss of self-esteem (studied by e.g. economists Bénabou and Tirole (2002)). If people believe they will perform badly, regardless of their efforts, they might deliberately place obstacles to their performances, which provides an external excuse for potential failure, rather than acknowledging that their own lack of abilities were the true reason for their unsatisfying achievements. Such obstacles can take the form of drinking alcohol the night before an exam - or procrastination. One sacrifices performance in order to avoid “losing face”.

However, in the meta-analysis of Steel (2007), perfectionism and fear of failure is found to be of smaller significance for procrastination than some studies indicate. He suggests that the effects might have been exacerbated partly by publication bias and also through their relationships with self-efficacy and self-esteem. These two traits are in turn claimed to be directly linked to procrastination (see e.g. Judge and Bono (2001)). Low self-efficacy implies

having doubts on the ability to perform at a desired level, while low self-esteem can make these doubts adversely affect one's self-image (Steel, 2007). Combining these two, believing that one will fail at a given task (low self-efficacy) can result in the belief that this possible failure will express inadequacy as a person (low self-esteem), and thus it might be tempting to rather avoid working on the task at all. Lindsley et al. (1995) suggest that there could be a self-reinforcing relationship between self-efficacy and procrastination. If procrastination lowers academic achievements, then this might cause lower self-efficacy, which in turn leads to more procrastination, and so on.

Age is likely to be inversely related to procrastination. O'Donoghue and Rabin (1999b) note that people who do not procrastinate much, do not necessarily behave that way because of an absence of self-control problems, but rather because they have developed schemes and techniques, such as external commitment devices, to avoid putting things off unnecessarily. We could then further conjecture that the development of such strategies is more likely to happen as people age. Another point is that adults, as opposed to students in their early twenties, usually have more binding commitments, such as children, a full-time job, a house that needs maintenance, et cetera. This dramatically increases the potential cost of procrastination and probably results in stricter time-management, at least compared to a student, whose procrastinatory habits mainly affect his academic achievements, which "can always be made up for next week". However, van Eerde (2003) notes that habits may grow more persistent and become increasingly difficult to change as one becomes older, so that the relationship between age and procrastination is not completely unambiguous.

Among other demographic variables, gender is found to be of little importance for procrastination, with most studies having mixed results, depending on the methodology and measure. When comparing a sample of 124 studies, Steel (2007) finds only a small and insignificant tendency for men to procrastinate more than women.

Intelligence, talent and aptitude is generally found to be of no significance for procrastination (see e.g. Ferrari (1991)). However, Tice and Baumeister (1997), among others, find that procrastinating students perform worse than their more dutiful counterparts. Despite the general lack of randomized controlled trials in procrastination studies, this evidence suggests that procrastination does indeed lower performance.

4.2 Temporal motivation theory (TMT)

Steel and König (2006) try to integrate and unify some of the main insights from the numer-

ous, seemingly disjoint studies of procrastination. The main elements of TMT are derived from expectancy theory and hyperbolic discounting, and can be represented by the following equation:

$$Utility = \frac{E \times V}{Z + \Gamma(T - t)}$$

Utility refers to the desirability of a given choice or a task, and individuals pursue at any time the option(s) that yields the highest utility. $E \times V$ is short for *Expectancy* \times *Value* and represents the contribution from expectancy theory, and is largely analogous to expected utility in economic models. However, *Expectancy* does not necessarily reflect an objective measure of the probability of obtaining a certain outcome, but can be affected by e.g. self-efficacy. Low self-efficacy lowers the perceived likelihood of succeeding on a given task, and will thus lower *Expectancy*. *Value* is the desirability of the object in question, absent of discounting and uncertainty. The value will be lower if the task is regarded as aversive, and higher for those with a high need for achievement. Γ measures the sensitivity to delay, and is positively affected by the levels of e.g. impulsivity, distractibility and boredom proneness, and $T - t$ is the delay from now until rewards are realized. Z is simply a constant preventing utility from approaching infinity for small delays.

They exemplify the intuition of the theory by describing a student who, at any time over the course of a semester, has two choices: to study for an exam, or to socialize. As social activities gives immediate rewards, the utility is relatively constant over time. The utility obtained from studying, however, is low in the beginning of the semester, since it is an immediately aversive activity while the rewards are received in the future, but increases gradually as the exam looms closer. Even though he, absent of discounting and uncertainty, values a good grade higher than he values socializing, the utility from socializing, as a function of time, might be higher than the utility from studying for a large part of the semester. Then, for high delay sensitivity and low expectancy, he might start studying much later than he initially preferred.

It is unclear what TMT has to add to the exploration of procrastination and related self-control problems, that the (β, δ) -model and other models developed by behavioral economist cannot already account for, despite Steel and König (2006) being strangely assertive with regards to the validity and relevance of their theory⁷. Although they assign a richer number

⁷Exemplified by the quote “It also appears that *only* TMT can account for its [procrastination] empirical findings” (Steel and König, 2006, p. 899)

of psychological interpretations to the variables they include than are usually mentioned in economic research, the theory appears largely open-ended. The story told above, could easily have been explained within the (β, δ) -framework, and in addition been enriched by providing some insight on naivete and sophistication. Steel (2007) does, however, admit that further research is needed in order test and improve the theory.

Part II

Survey

5 Survey design and relation to the theory

Procrastination and present bias is inherently hard to measure and identify. One strand of the literature (see e.g. Paola and Scoppa (2014); Schiming (2012)) simply records the time subjects spend doing some task which typically requires little, but immediate effort, and interprets any delay as procrastination. However, there could be many reasons for delaying a task, and procrastination is just one of them. Hence, there is reason to believe that these studies wrongfully attribute some delay that is due to, say, people being busy and therefore intentionally postpone task completion close to the deadline, as procrastination. Another part of the literature typically asks subjects directly about their procrastinatory behavior. But as procrastination is viewed as a problematic and harmful habit, these self-reported measures are likely to be biased and incentive incompatible, as subjects might want to justify their self-image, or simply do not realize that they are procrastinating (i.e., they are naive).

The analysis performed in this thesis is also based on a self-report survey. But instead of asking directly about procrastination, I try to identify how well the subjects (students) are prepared for two certain lectures in the same course. My conjecture is that revealing how well you have prepared for a lecture requires less painful introspection than admitting to procrastination, and then hopefully facilitates less sensitivity to incentive incompatibility and self-report bias than previous studies. Clearly, solely identifying how well prepared a student is for a lecture, will probably uncover even less information on procrastination and present bias than observing delay, since there could be numerous reasons for being well or poorly prepared. Therefore, the levels of preparation was measured by two different surveys for two different lectures, and the difference between these levels is what is of interest. Before the first lecture, the students were encouraged to do some online multiple choice exercises in order to prepare. By completing these exercises, the students would also receive some extra points on an upcoming, mandatory exercise. For the second lecture, no such alternative existed, and the students had to rely on reading the textbook as preparation. The hypothesis is that students who suffer from present bias will be better prepared for the first than the second lecture, due to the availability of preparation exercises. Firstly, it is reasonable to believe that doing exercises designed exclusively for the purpose of the relevant lecture, in particular

on the multiple choice form, requires less immediate effort than do reading a textbook, where one has to spend time filtering and extracting the relevant information. Secondly, finishing an exercise might give some feeling of accomplishment and capability, which can be interpreted as immediate rewards. Thirdly, the preparation exercises create a clear deadline for when effort should have been undertaken. They were only available before, not after the lecture. For the second lecture, reading the textbook was clearly an option also after the lecture, and for sufficient costs related to reading, present biased students would be likely to procrastinate their preparations. Hence, the rationale is that procrastinating students will be identified by being better prepared for the first than the second lecture.

One important note is that the online preparation exercises were not an exclusive one-time offer for the particular lecture where the first survey was conducted. Such exercises were available before a total of nine lectures, and the survey took place during the sixth of these nine. Due to this, the students should already have been familiar with the concept of these exercises, and obtained a relatively clear idea of how they would benefit from doing them. And as mentioned, in order to further incentivize the completion of the preparation exercises, besides the benefit of being better prepared, the students who completed them would receive three extra points per exercise on an upcoming, mandatory exercise, that they needed to pass in order to take the exam. This constitutes a very concrete, but future reward. I have data on the number of completed preparation exercises and scores on the mandatory exercise, but unfortunately I have been unable to link these data to the survey data, due to requirements on anonymity and privacy. However, it will be possible to draw some insight on the effect of preparations on academic results.

6 A simple model of academic procrastination

In order to illuminate the relationship between procrastination, present bias and the surveys that were conducted, I here present a simple O'Donoghue and Rabin-style model of the decision making process of a present biased student who considers when to prepare for a lecture. Let the student have (β, δ) -preferences as described in Section 3.2, that is,

$$U^t(u_t, u_{t+1}, \dots, u_T) = u_t + \beta \sum_{\tau=1}^{T-t} \delta^\tau u_{t+\tau}, \quad 0 < \beta < 1$$

The lecture takes place on Monday, and suppose he can start preparing on Friday the week before. Preparing requires only a one-time effort. Monday constitutes in a sense a “soft” deadline, which is very typical in academia, and in life in general. Hence, he can also “prepare” after the lecture, but this will generate a lower benefit. The baseline benefit of preparing is denoted $B > 0$, which he receives regardless of when he does it. However, if he prepares before the lecture, he receives $B + b$, where $b > 0$ reflects the gain from appreciating the lecture more.

Table 1: Rewards and costs with prep. exercises

Preparation day	Fri	Sat	Sun	<i>Mon</i>	Tue
Cost	c	$c + h$	$c + h$	c	c
Reward	$B + b$	$B + b$	$B + b$	B	B

Let $h \geq 0$ represent an extra cost incurred when preparing on Saturday or Sunday. This is due to the student having more tempting outside options during the weekend, such as socializing. Now, the crucial factor here is the timing of costs and rewards. As before, we assume that the cost is experienced immediately, since it reflects the aversiveness of exerting effort and the loss of not experiencing outside opportunities. The benefit, on the other hand, is received some time in the future. For example, if he prepares on day $\tau = \text{Friday}$, then his instantaneous utility is $u_\tau = -c$, and some time later, $u_{\tau+s} = B + b$. Importantly, since preparation is assumed to be a one-time activity, $u_t = 0$ for all $t \neq (\tau, \tau + s)$. Then his intertemporal utility function, as seen from Friday, becomes $U^\tau = -c + \beta\delta^s(B + b)$. Let us assume that $B \geq c$, so that, absent of discounting, the net benefit of preparing is positive, even after the lecture. If the student does not prepare at all, he obtains zero utility.

Recall again the definition of naive and sophisticated agents: naifs have present biased prefer-

ences, but believe that they will behave as exponential discounters in the future. Sophisticates have present biased preferences, but they perfectly predict their future self-control problems. Assume, for simplicity, as in the numerical example of Section 3.3, that $\delta = 1$, i.e., there is no long-run discounting.

6.1 Behavior for $h = 0$

In order to illustrate the decision of interest - whether or not to be prepared for a lecture - in its simplest form, let first $h = 0$, so that we have constant cost schedule.

Let us also, as a benchmark, first consider an exponential discounter ($\beta = 1$). Since $\delta = 1$, he does not discount future rewards and costs at all. His decision problem is trivial in this case, as he can simply choose to prepare on the day that maximizes the undiscounted net benefits. For $h = 0$, he is indifferent between preparing on any of the first three days. Let us then assume that he will prepare on Friday. However, his game theoretic strategy would be to prepare on any day, also on Monday and Tuesday, since $B - c \geq 0$.

6.1.1 Naive student

Now we return to the case where $\beta \in (0, 1)$. The behavior of a naive, present biased student can be described as follows. At $t = 0$, or Thursday the week before the lecture, he both plans and expects to prepare the next day, as an exponential discounter would do. But on Friday, his preferences has changed, and he will only prepare if $\beta(B + b) - c \geq \beta(B + b - c)$, which is never satisfied for $\beta \in (0, 1)$. Hence, he will always procrastinate on Friday. This is intuitive, since the net benefits from preparing on Friday equals those from doing it on Saturday. Since an exponential discounter with $\delta = 1$ is indifferent between doing it on Friday and Saturday, even an arbitrarily small preference for the present induces him to postpone preparations. He will also procrastinate on Saturday, by the exact same argument. On Sunday, he prepares if $\beta(B + b) - c \geq \beta(B - c)$, which simplifies to $c \leq \frac{\beta}{1-\beta}b$. $\frac{\beta}{1-\beta}$ is increasing in $\beta \in (0, 1)$, so the more present biased the student is (the lower β) is, the more likely⁸ he is to procrastinate. On Monday he will procrastinate, by the same arguments as for Saturday. On Tuesday, he will prepare if $c \leq \beta B$, which might not hold. In fact, every single day, he believes that he will prepare the next day, but under certain conditions, he may end up not doing anything at all.

⁸I use the word “likely” in the sense that he will procrastinate for a larger range of costs. Since we are in a deterministic environment, this should not be confused with the *probability* that he will procrastinate or prepare, which is meaningless to talk about here.

6.1.2 Sophisticated student

In order to characterize the decision making process of a sophisticated present biased student, we can apply backward induction, as in Section 3.3. Starting from the last day, let us see what we get.

On Tuesday, he will only prepare if $c \leq \beta B$, which is the same criterion as the naive student applies. On Monday, he knows that if $c \leq \beta B$, he will do it on Tuesday. If that is the case, he procrastinates on Monday, since $\beta B - c < \beta(B - c)$. If $c > \beta B$ he will neither prepare on Tuesday, nor Monday. Consequently, he will never prepare on Monday. On Sunday, if $c \leq \beta B$, he knows that he will do it on Tuesday. In that case, he prepares only if $c \leq \frac{\beta}{1-\beta}b$, which the same criterion as the naive student applies. However, if $c > \beta B$, he does it if $\beta(B + b) - c \geq 0$. The sophisticate realizes that if he does not do it now, he will not prepare at all and obtain zero, and therefore he prepares on Sunday if that gives him positive net benefit. Hence, if $\beta B < c \leq \beta(B + b)$, we are in a situation where the sophisticated student prepares, while the naif procrastinates. He will never prepare on Saturday or Friday, based on a corresponding argument as the one made for Monday.

The results for the naif and the sophisticate are summarized in Proposition 1.

Proposition 1. *For a constant cost schedule ($h = 0$), the naive student will prepare on Sunday if*

$$c \leq \frac{\beta}{1-\beta}b.$$

The sophisticated student prepares on Sunday if

$$c \leq \frac{\beta}{1-\beta}b$$

or if

$$c \in (\beta B, \beta(B + b)].$$

They both prepare on Tuesday if

$$c \leq \beta B.$$

Proof. The proof follows from the discussion above. ■

The first lecture where the students were surveyed was held on a Monday, the second on a Wednesday. And as mentioned, the preparation exercises were only available before the first lecture, and by completing these, the students would receive extra points on an upcoming, mandatory exercise. Consequently, the case described above does in fact resemble the lecture held on Wednesday more than it does Monday, since we assumed $h = 0$. Within this framework, modeling the Monday lecture with more realism would imply a higher b (since preparing does now entail extra points on the mandatory exercise) and $h > 0$ on Saturday and Sunday. Let us analyze these two aspects (changes in b and h) separately, in order to keep things simple.

First, consider an increase in the benefit from preparing before the lecture. Assume that by preparing on Friday, Saturday or Sunday, the student now obtains $\hat{b} > b$, in addition to B as before. One interesting observation is that \hat{b} is a parameter that a prospective principal, e.g., a professor or supervisor, can influence by changing the number of extra points the student obtains on the mandatory exercise from doing the preparation exercise. How will this change the decisions of the student? It follows directly from Proposition 1 that it will only affect behavior on Sunday. The net benefits from preparing on Monday or Tuesday remains unchanged, while an exponential discounter still would be indifferent between which of the three first days he prepares. Hence, the present biased student will continue to procrastinate on Friday and Saturday, regardless of sophistication and naivete. Then on Sunday, we see that when going from benefit b to $\hat{b} > b$, the range of costs for which both the naive and sophisticated student prepares increases by $\frac{\beta}{1-\beta}(\hat{b}-b)$. In addition, the cost interval for which the sophisticate prepares, while the naif procrastinates, increases by $\beta(\hat{b}-b)$.

Proposition 2. *Increasing b will increase the likelihood that both the naive and sophisticated student prepare on Sunday.*

Proof. The proof follows from the discussion above. ■

Proposition 2 might seem very plain and obvious. An interesting observation, however, is that the more present biased the student is, the less sensitive he is to changes in the future benefit. Clearly, the lower β is, the more likely he is to procrastinate in the first place, but he is also less likely to change his behavior when b increases to \hat{b} . For example, if $\beta = 0.4$, a unit increase in b would only increase the range of costs for which the naif prepares by 0.67. The reciprocal would be the case if the benefit was to be reduced. This is important to note for a professor or supervisor who wants to induce his students to prepare. If the future reward, b , is increased by offering more points on the mandatory exercise, this would motivate students with high β 's more than those who suffer severely from present bias.

Now, let us consider the case where preparing during the weekend entails an extra cost $h > 0$ because of lost outside opportunities. Assume that $h < b$, so that, absent of discounting, it is still more beneficial to prepare before the lecture than after. As in the case with an increase in the benefit, behavior on Monday and Tuesday remains unchanged for both types of students. On Sunday, however, the naif will now only prepare for $c \leq \frac{\beta}{1-\beta}(b - \frac{h}{\beta})$, which is a more restricting condition than in Proposition 1. The sophisticate will also apply this criterion, but if he realizes that he will not prepare on Tuesday (if $c > \beta B$), he also prepares if $c \in (\beta B, \beta(B+b) - h]$. Again, this is a tighter interval than in Proposition 1. On Saturday they will both procrastinate, since net benefits are the same as on Sunday. On Friday, the naif will now prepare if $c \leq \frac{\beta}{1-\beta}h$. The sophisticate also applies this criterion. We see that a higher opportunity cost from preparing during the weekend makes both types of students more likely to prepare on Friday. We also see that the more present biased he is (lower β), the less concerned he is about having to face higher costs the next day, and he is more likely to procrastinate. In addition, the sophisticated student will prepare on Friday if he realizes that he will neither prepare on Sunday, nor Tuesday and $c \in (\beta B, \beta(B+b)]$.

Proposition 3. *Having an opportunity cost $h \in (0, b)$ during the weekend makes both the naif and the sophisticate less likely to prepare on Sunday. However, both types might now prepare on Friday. In sum, the sophisticate is just as likely to prepare before the lecture in this case, as when $h = 0$. The naif is less likely to prepare before the lecture in this case.*

Proof. The proof for the two first sentences of the proposition follows from the discussion above. That the sophisticate in sum is equally likely to prepare before the lecture in this case as when $h = 0$, follows by observing that he in both cases will prepare on either Friday or Sunday for $c \in (0, \beta(B+b)]$. That the naif in this case is less likely to prepare before the lecture follows by observing that his criterion for preparing on Friday is stricter than for Sunday (since $\frac{\beta}{1-\beta}(b - \frac{h}{\beta}) > \frac{\beta}{1-\beta}h$ for $h < b$), and his criterion for preparing on Sunday with $h > 0$ is stricter than the criterion that he applies when $h = 0$ (since $\frac{\beta}{1-\beta}(b - \frac{h}{\beta}) < \frac{\beta}{1-\beta}b$). ■

The model above provides insight on how present bias and procrastination can affect lecture preparations. We see that incentivizing the students with some extra benefits from preparing before the lecture will make preparations more likely, but since these rewards are received in the future, it will motivate students with only a small present bias more than it will motivate those who struggle the most with procrastination. In order to resemble the Monday lecture as the students in the survey experienced it, we should try to add the elements of higher benefit \hat{b} and opportunity cost h simultaneously. If we do this, it follows that if $\hat{b} > b + \frac{h}{\beta}$, both types of students are unambiguously more likely to prepare before the lecture than they are in the case summarized by Proposition 1, which resembles the Wednesday lecture.

In Section 5, I claim that the main feature of the preparation exercises is related to the idea that they effectively lower the immediate cost of preparing. Despite this, I have not explicitly included the aspect in the analysis above. Adding the cost-related element of the preparation exercises to the model, could have been done by assuming a lower cost on Friday, Saturday and Sunday. This would of course affect the criteria the student applies when deciding whether to prepare or not, and in particular, make preparations even more likely for both types of students for the Monday lecture. However, I believe that the intuition obtained from considering the two cases summarized by Propositions 2 and 3 is sufficient for our purpose. The issue of lower effort costs resulting from the preparation exercises being available will be discussed more during the analysis of the survey data.

6.2 Extensions and limitations of the model

The model described above is very stylized and simple. I have dropped the aspect of partial naivete, as well as multitasking, which was briefly discussed in Section 3.2. Another interesting extension could be to allow for stochastic costs, so that the schedule is not completely known by the student in advance. For example, on each day, the task cost c is drawn from distribution C with cumulative distribution function $F(c)$. The uncertainty of task cost could reflect (1) the casual observation that some days, effort seems to be more easily provided than other days; you can simply have a “good day”, and (2) the opportunity cost of effort is often externally determined in the form of surprises, as you might suddenly be invited to an exciting, but unanticipated event, you might catch a cold, et cetera. Bisin and Hyndman (2014) find that in this case, the student will obey a cutoff rule, i.e., he decides that for some sufficiently low cost realization \underline{c} , he completes the task. They show that the cutoff will generally be lower for present biased sophisticates than for exponential discounters, and even lower for naifs than for sophisticates.

When it comes to limitations, one point is that the student enters into the model without any history, nor any future beyond Wednesday. Fortunately, the real world students in the survey are of course affected by what they did in the past, and by what they plan to do in subsequent weeks. If effort costs vary from day to day, and preparations has to be done repeatedly over time, we could imagine that (sophisticated) students would do some “precautionary” studying early in the semester in order to guard against high-cost days. With this in mind, the results of the survey will be affected by whether the students were investigated during high or low-cost days, and it is hard to control for this. Another issue is that different students probably value the benefits of being prepared heterogeneously. Regardless of present bias,

some students might take the course simply because they need some credits in economics, while others have more serious ambitions for their academic careers. And even among those with high goals, it is not obvious that they all will channel their ambitions through being well prepared for lectures. Ultimately, what matters most is probably the final grade on the exam, and the highest ability students might not need to prepare much for lectures in order to achieve this, regardless of issues of present bias. I have tried to control for some aspects of this matter in the survey, e.g. by asking about the student's attitudes towards different types of teaching and learning.

The assumption that the students have more tempting outside options during the weekend, and therefore incur higher cost from preparing on Saturday and Sunday, might be a bit arbitrary. Some students are probably extremely busy during weekdays, and might actually find it less costly to study during the weekend. The assumption was made mainly in order to emphasize that outside opportunities does indeed matter for procrastination. And the fact that the first survey was held on a Monday and the second on a Wednesday is likely to have affected the results - but it is not straightforward to predict in which direction.

7 Data collection and summary statistics

Data was collected at two lectures in an introductory mathematics and microeconomics course at the the Department of Economics, University of Oslo. The first survey was held on a Monday, the second on the Wednesday two days later. These can be found in Appendix A (in Norwegian). The questionnaires were distributed on paper during the breaks of the lectures. The students were told that the surveys were a part of a master thesis at the department, and that the objective was to analyze their study habits. They were also informed, during the first survey, that the second survey would ensue, but not when it would take place. In order to identify the students across the two surveys, while still preserving their anonymity, they were asked to write down the four last digits of their phone number.

The first survey consisted of five demographic questions and then seven statements regarding study habits, that were answered on the form of a 5-point Likert-type scale (from strongly agree to strongly disagree). The second survey consisted of five Likert-type statements. The only recurring statement was the one measuring how well prepared the students were for the lecture. In order to maximize the number of participants in the absence of financial incentives, the surveys were aimed at being short and quick to finish, as students probably prefer to fill their lecture breaks with recreational activities, rather than answering questionnaires.

The number of students who completed all the elements of both surveys amounted to 55. In addition, 22 students only participated in the first survey. Whether this is due to them not being present at the second lecture, or if they simply did not bother to respond to the second survey is not known. Around 100 students attended each of the lectures, so I believe the participation rate is fairly good, given that it was emphasized that participation was voluntary and that they did not have any financial incentives to complete the surveys. Summary statistics for the 55 complete responses are given in Table 2. Note that the variables based on the Likert-type statements ⁹ are limited to the interval $[-2, 2]$. A value of -2 means “strongly disagree” and 2 means “strongly agree”, while 0 implies a neutral response to the statement. The exception is *prepdiff*, which is defined as the difference between the reported level of preparations on Monday and Wednesday, respectively, and consequently has potential range $[-4, 4]$. Below, I discuss the variables, as well as potential weaknesses related to the data.

⁹This concerns the variables *prepmon*, *prepwd*, *prepalways*, *goodreason*, *difficult*, *waste*, *seminars*, *reader*, and *extra*.

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
prepdiff	0.382	1.394	-3	4
prepmon	0.655	1.126	-2	2
prepwed	0.273	1.407	-2	2
age	21.236	2.027	19	27
job	0.564	0.501	0	1
exams	1.509	0.836	0	3
hours	17.718	10.22	2	45
exercises	0.818	0.389	0	1
prepalways	0.273	1.008	-2	2
goodreason	-0.018	1.097	-2	2
prepdifficult	-0.909	0.888	-2	1
waste	-1.091	0.986	-2	2
seminars	0.509	1.136	-2	2
reader	-0.4	1.271	-2	2
extra	-0.382	1.354	-2	2
N		55		

7.1 Variables

- *age* - The average age is 21.2, and is fairly stable across the group. More than 40% of the students are 19 or 20 years old, which means that they are relatively unexperienced and new to studying at the university level.
- *job* - This dummy variable equals one if the student has a job, zero otherwise. 56.4% of the students have a job. Among these, only one reported that he or she works full time, the rest has a part time job.
- *exercises* - Also a dummy variable, which equals one if the student has done the preparation exercises for the Monday lecture. 81.8% of the students reported that they had done so.
- *hours* - The students were asked to estimate the total amount of time they spend studying each week, excluding time spent on lectures and seminars, counting only the number of hours reading, working on exercises and other study related activities. The average number of hours studying per week is 17.7. The variability here is large, with responses ranging from two to 45 hours per week. It might be an issue of imperfect recall, as most students probably do not specifically count how many hours they spend studying on average. Also, different students might even have different definitions of

what qualifies as studying. Some may count the total time they spend on campus, only subtracting the hours of teaching, while others report the hours of effective studying.

- *exams* - The number of courses the students are taking this semester, in addition to the course where the survey was held. The average student reports that he is taking 1.5 courses this semester, with more than 30% of them taking three or more courses in total. I suspect, however, that this mean might be somewhat upward biased ¹⁰. It is quite common among students at UiO to register for more courses than they realistically plan to complete, due to both registering and unregistering being costless as long as it is done sufficiently far ahead of the exam. As the survey was held fairly early in the semester, it is possible that some of the students were overly optimistic about how many exams they would be able to complete in the end. If the survey question had been specified as “how many exams do you *realistically* plan to take this semester?”, the result might have been different.
- *prepdiff* - Defined as *prepmon* minus *prepwed*, i.e., the difference between the reported level of preparations on Monday and Wednesday, respectively. A positive value here implies being better prepared for the lecture on Monday than for Wednesday, which is the hypothesized effect from the preparation exercises being available only before Monday. And indeed, the average reported preparation difference is positive at 0.382.
- *prepalways* - This variable measures the response to the statement “I am always prepared for lectures and seminars”, and is meant to capture the effect from some students simply being very dutiful, and always preparing, regardless of the availability of preparation exercises. Almost 50% of the students agreed to the statement (i.e., a value of 1 or 2), with an average value of 0.273.
- *goodreason* - This variable measures the response to the statement “I usually have a valid reason not to be prepared” and is aimed to reflect the possibility that some subjects are more busy, and might get distracted or be unable to prepare, without necessarily procrastinating. While the mean value, -0.018, implies that there is no systematical tendency towards lack of preparations being due to unanticipated events, 69% of the students do in fact disagree or give a neutral response to the statement.

¹⁰The course where the survey was held is a 20-credits course, while the vast majority of courses constitute 10 credits. The university standard is to take 30 credits each semester. The students that reported they were taking more than one additional course, may be aiming at completing an economics degree at less than the standard time, but they could just as well be resitting exams from the last semester. Hence, whether these students are extremely ambitious, or simply regret their performance last semester, is hard to tell.

- *prepdifficult* - This variable is the response to the statement “I find it difficult to prepare for lectures”, and measures the difficulties the students experience in relation to seeking out the relevant reading material and applying it to their preparations, and can in some sense be interpreted as a vague measure of the costs related to reading for a lecture. The average, -0.909, means that they generally do not find it very difficult.
- *waste* - This variable measures the response to the statement “I think preparing for lectures is a waste” and is meant to identify the students who do not value being prepared for lectures, and rather prefer to spend their study hours repeating previous material or other things. In terms of the model in Section 6, a negative response does not necessarily imply $B + b = 0$, but simply reflects that some students value other things a more, and with a time budget bounded by the earth’s rotation, they prioritize these other things, rather than preparing for lectures. However, with a mean of -1.091, the students largely disagree with the statement, and do in fact value being prepared. Less than 8% of them did agree.
- *seminars* - This variable is the response to the statement “I am generally better prepared for seminars than for lectures” and is meant to give some measure of the relative preference for being prepared for seminars rather than lectures. The teaching at seminars consists of going through the solutions to exercises that the students are supposed to have worked on in advance, and is known to typically be more exam relevant than lectures. For a student who experiences high cost of reading, it might be both tempting and sensible to allocate relatively more time to seminar preparations. The students generally agree with this, with a mean of 0.509.
- *reader* - This variable measures the response to the statement “I prefer reading to doing exercises”, and is in some sense similar to the previous variable, but here the students are asked directly about their relative preferences between reading and doing exercises. The statement is also reversed, so here a negative value implies a higher relative cost of reading. The average is -0.4, which is consistent with the previous variable having a positive mean, and the correlation between these two is -0.228.
- *extra* - This variable measures the response to the statement “I have done extra preparations for today [Wednesday]”. The Wednesday lecture was the first lecture covering microeconomic theory, whereas the previous lectures had all been dedicated to calculus. This introduced a new lecturer and a new textbook, and I conjectured that some students might do extra preparations for this lecture, in order to, say, start the new part of the course with a “clean slate”. This effect was not very prevalent, with a mean of

-0.381. However, the correlation between *extra* and *prepdiff*, is significant and negative at -0.432. The drawback here is that the statement is posed in such a way, that the students might have interpreted it in different ways. If a student induced no extra effort for Wednesday, it is unclear whether this should be reflected by a neutral response, or by a disagreeing response.

8 Results and analysis

A starting point for the analysis could be to look at the relationship between the total number of preparation exercises the students completed over the course of the semester and their score on the mandatory exercise. Results from a simple regression of score (*scoreoblig*) on the number of completed preparation exercises (*noofprepex*) are given in Table 3 ¹¹.

Table 3: Regression table	
	(1)
	sumoblig
noofprepex	1.145* (0.530)
Constant	65.26*** (1.594)
Observations	128
R^2	0.036
Adjusted R^2	0.028
Standard errors in parentheses	
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$	

As discussed at the end of Section 5, this is not a part of the dataset obtained from the surveys, and involves a large number of students that did not respond to the questionnaires. It is possible that students that participated in the survey have characteristics that differ from those who did not, and therefore we cannot make any claims on how these results relates to the results from the survey. What we can claim, is that there is a significant, positive relationship between the completion of preparation exercises and score on the mandatory exercise for the full sample of 128 students. Doing one extra preparation exercise yield, on average, 1.145 extra points the mandatory exercise. The average student completed around six of the nine preparation exercises, so that he would gain roughly $1.145 \times 6 = 6.87$ points on the mandatory exercise, in addition to the $3 \times 6 = 18$ extra points he automatically received from doing the preparation exercises.

It is of course futile to assume that the number of completed preparation exercises is the main predictor for how well the students do. Unobservable variables such as ability and motivation are likely to be more important. The students that did the exercises might be more active and

¹¹The variable *noofprepex* has been mean centered, which implies that the intercept equals the average score (65 out of 100). 65 is in fact also the lowest passing score. By doing all the preparation exercises, the students could achieve at most 27 extra points, and by including these, the mean is 84.4 points.

motivated, and have better abilities than students who did not (i.e., they self-select into the preparation “treatment”), and would therefore have done better on the mandatory exercise even if they did not prepare for lectures. One issue might have dampened the observed effect from doing the preparation exercises. Since they received extra points “for free” by completing them, the students were given an incentive to put less effort into the mandatory exercise. Since it is only evaluated as pass/fail, it is reasonable to believe that most of the students to some extent try to keep account of how likely they are to pass, and for some threshold, the marginal gain from putting more effort into the assignment might drop drastically. For a student who completed most of the preparation exercises, and already had secured a lot of points, this threshold might be relatively low. One last concern, as mentioned in Section 6.2, is that it is not obvious that the most ambitious and highest ability students all channel their aspirations through preparing well for lectures. This is exemplified in the data by the fact that the highest scoring student on the mandatory exercise completed a total of zero preparation exercises. The only thing we can conclude is that students that prepare well, on average seem to have better academic performance than students that do not, and that should not be very surprising. The question then becomes *who* prepares well and what does procrastination and present bias have to do with it.

Let us now turn to the survey data. First of all, let us formally test the main hypothesis of the survey: That there is a significant difference in average preparation levels on Monday and Wednesday, and in particular, that the students are more prepared for the first lecture than for the second. This amounts to testing the hypothesis

$$H_0 : \overline{prepdiff} = 0 \text{ against } H_1 : \overline{prepdiff} > 0.$$

Since $t = \frac{0.382}{1.394/\sqrt{55}} = 2.031 > t_{(0.95,54)}$, we reject the null hypothesis that there is no positive preparation difference between Monday and Wednesday at the 95% significance level. However, this does of course not tell us anything about *why* the students are more prepared for Monday than for Wednesday. One discouraging possibility is for example that the only difference is that students who did the preparation exercises *perceive* that they are more prepared, while the “true” preparation level remains unaffected. This hypothetical, true level is of course unobservable, and we have to make do with the self-reported measure.

Regression results with *prepdiff* as the dependent variable are shown in Table 4. Again, the explanatory variables have been mean centered, so that the intercept α has interpretation

$$\alpha = E[Y_i \mid \mathbf{x}=(\bar{x}_1, \bar{x}_2, \dots, \bar{x}_n)]$$

Table 4: Regression table

	(1)	(2)	(3)	(4)
	prepdiff	prepdiff	prepdiff	prepdiff
job	0.822* (0.331)	0.809* (0.334)	0.816* (0.332)	0.693* (0.324)
exams	-0.313 (0.183)	-0.299 (0.184)	-0.286 (0.183)	-0.232 (0.181)
hours	0.0291 (0.0169)	0.0242 (0.0165)	0.0235 (0.0164)	
exercises	-0.336 (0.437)	-0.353 (0.440)		
prepalways	0.506* (0.225)	0.447* (0.222)	0.382 (0.206)	0.416* (0.206)
goodreason	-0.422* (0.181)	-0.408* (0.182)	-0.387* (0.179)	-0.348 (0.179)
waste	0.205 (0.162)			
seminars	-0.448** (0.150)	-0.475** (0.150)	-0.466** (0.149)	-0.448** (0.150)
reader	-0.294* (0.123)	-0.307* (0.124)	-0.294* (0.122)	-0.276* (0.123)
extra	-0.400** (0.126)	-0.411** (0.127)	-0.426** (0.125)	-0.393** (0.124)
Intercept	0.382* (0.142)	0.382* (0.143)	0.382* (0.143)	0.382* (0.144)
Observations	55	55	55	55
R^2	0.533	0.516	0.509	0.488
Adjusted R^2	0.427	0.420	0.424	0.411

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

where Y_i is the dependent variable and \mathbf{x} is a vector of explanatory variables. In our case, the intercept is now the mean of *prepdiff*, at the mean of all the predictor variables.

Not surprisingly, perhaps, whether a student has a job or not seems to be a major determining factor for the difference in preparation levels between the two lectures, with a coefficient of around 0.8 for the three first regression specifications. The intuition could be that students that work are more busy and have a tighter schedule, generally giving them less time to prepare. Then, for the Monday lecture, the preparation exercises were available, which made preparing easier and less costly in terms of time spent. Consequently, students with a job were relatively more prepared for Monday, than students with no job. Another point is that working students might be more busy during weekdays than in weekends, so that they could find it less costly to prepare during weekends, which of course is the opposite of what was hypothesized in the model of Section 6. If this is the case it could further inflate the effect from having a job on *prepdiff*.

Table 5: Partitioned summary statistics for *job*

	<i>job</i> = 0			<i>job</i> = 1		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev
<i>prepdiff</i>	24	0.042	1.160	31	0.645	1.518
<i>prepmon</i>	24	0.708	1.122	31	0.613	1.145
<i>prepwed</i>	24	0.667	1.404	31	-0.032	1.354

In Table 5, the preparation variables are summarized for students with no job and a job, respectively. We see that non-working students are better prepared for both lectures, but the difference between the two groups is much more emphasized on the Wednesday lecture.

The number of exams has a negative, but insignificant impact on *prepdiff*. It can be argued that the sign is not intuitive, as the act of taking a high number of courses during the semester should make students more busy, and accordingly have a similar effect as having a job. But as mentioned in footnote 10, there is some ambiguity on what types of students that actually sign up for a higher number of exams than required, and since it is not significantly different from zero, there is not much we can say about the effect of *exams*.

The number of hours of studying each week seems to have a very negligible and insignificant effect on the dependent variable. However, I believe it is important to control for, as it intuitively should say a lot about the study habits of the subjects, and the variability is very large ($\sigma = 10.22$). In fact, for the average student in the sample, the effect would be

approximately $17.7 \times 0.02 = 0.354$. Furthermore, the correlations between *hours* and *prepmon* and *prepwed* are 0.340 and 0.373, respectively. Hence, the number of study hours seems to have a positive relationship with how well prepared the students are in general. This is intuitive, since it is reasonable to believe that those who spend a lot of hours studying do so because they are motivated, active and able students. And, as discussed earlier, it might be the case that these students are not considerably affected by the availability of preparation exercises, in the sense that they tend to be well prepared regardless of circumstances and degree of present bias.

The coefficient on *exercises* is negative, but not significantly different from zero. Considering the fact that the students were better prepared for Monday than for Tuesday, we would expect that having done the preparation exercises contributed to this, and therefore a positive coefficient. The reason why the data tells us differently could be that the vast majority of the students (82%) did in fact do the exercises. Then there is very little revealed information in the choice of completing the exercises, and other characteristics of the students might dominate in explaining the preparation difference.

The coefficient on *prepalways* is positive, and significantly different from zero at the 95%-level in three of the four specifications. This might also seem counterintuitive. If a student always is well prepared for lectures, we would of course not expect that he is better prepared for the Monday lecture than for Wednesday. However, we must not forget that these are self-reported assessments. One issue in this regard is that the statement, from which *prepalways* is generated, was reported during the Monday lecture. And it is possible that some of the students, consciously or not, strive to maintain some kind of consistency in their survey responses. That is, if they report that they are well prepared on Monday, they might be more likely to report that they are always well prepared, independent of whether that is a “correct” assessment or not. This idea is supported by the fact that the correlation between *prepalways* and *prepmon* is strong at 0.656, while the correlation with *prepwed* is still significant and positive, but lower at 0.390. Hence, students who report that they are always well prepared, do seem to be well prepared at both lectures, but more so on Monday, possibly due to some degree of dependency of individual responses within each of the surveys. Another point is that the students who report high levels of *prepalways* probably have low costs of preparing, even without available preparation exercises, and/or they value the benefits from being prepared highly, which in turn could mean that they are not particularly present biased. In either case, it is reasonable to believe that for this group, the supply of preparation exercises does not induce them to substitute away from traditional methods of preparing, such as reading the textbook - rather, they might choose to add the preparation exercises on top of their

“baseline” preparations, since it is relatively inexpensive for them.

The coefficient on *goodreason* is negative and significantly different from zero in all but one of the specifications. It is perhaps not obvious which sign we should have expected here. Students that usually have a valid reason for not being prepared, are probably well prepared for most lectures. Indeed, the correlation between *goodreason* and *prepalways* is high at 0.641. And as argued in Section 7.1, students who respond positively to this statement might be more busy, and have more binding commitments than others. This suggests that there should be a positive relationship between *prepdiff* and *goodreason*, like that we see for *job*. However, we observe the opposite. Since the responses to this statement were recorded on Monday, one possibility is that some students may (perhaps unconsciously) rationalize and/or justify low levels of preparation by stating that they have good reasons for not being prepared, even if that is not objectively true. This could create a negative relationship. However, the correlation between *prepmon* and *goodreason* is significant and positive, so that this explanation seems unlikely to be valid. Then, another possibility could be that there is a relationship between *goodreason*, present bias and the level of sophistication. I believe that it does require some sophistication to admit to not having good reasons for not being prepared. And implicitly, a student stating this, is also stating that he does not regard preparations as unimportant (because thinking preparing is unimportant is a good reason not to prepare), which suggests that he prepares less than he wants, and that he is aware of his misbehavior. Therefore, the negative relationship between *goodreason* and *prepdiff* might exist because those who admit to not having good reasons for being unprepared could be sophisticated procrastinators - and that they profit from the availability of the preparation exercises more than those who have good reasons do.

Whether the students think preparing is a waste or not has a positive, but insignificant effect on the preparation difference. It can be argued that a slightly positive relationship is intuitive, since for a student who normally does not value being prepared, the availability of preparation exercises might make him somewhat more likely to prepare. This is contingent on the reason why he considers preparing to be a waste being that he has a lot of other things to do, and preparing is low on his priority list - not that he, for some reason, fiercely dislikes to be prepared. In that case, he would of course never prepare, what so ever.

The coefficient on *seminars* is negative, significantly different from zero (at the 99%-level) and fairly stable across all four specifications. However, it is not immediately intuitive why we find a negative relationship here. If a student values being prepared for a seminar more than he values being prepared for lectures, it is not obvious to see why that implies being relatively less prepared for the Monday lecture. In fact, a positive response to the statement

could mean that the student experiences high costs of preparing, and therefore allocates more of his effort to seminar preparations - then, the availability of preparation exercises should make him more likely to prepare for Monday, and consequently we should see a positive relationship here. In Table 6, summary statistics for *seminars* are shown separately for those who agree to the statement, and for those who disagree or give a neutral response.

Table 6: Partitioned summary statistics for *seminars*

	<i>seminars</i> > 0			<i>seminars</i> ≤ 0		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev
<i>prepdiff</i>	33	-0.030	0.984	22	1	1.690
<i>prepmon</i>	33	0.455	1.121	22	0.955	1.090
<i>prepwd</i>	33	0.485	1.349	22	-0.045	1.463

We see that those who report that they usually are better prepared for seminars than for lectures, on average in fact are more or less equally well prepared for Monday and Wednesday. Apparently, this group do not react to the availability of the preparation exercises, possibly because they do not value being prepared for lectures. However, there is no correlation between *seminars* and *waste*. We see that the negative relationship between *seminars* and *prepdiff* rather stems from the fact that the group that claim they are *not* better prepared for seminars than for lectures actually are much better prepared for Monday than for Wednesday. That they are well prepared for Monday is not surprising - if they regard preparing for lectures as important, they are probably benefiting from the availability of the preparation exercises. What is hard to explain is why the level of preparations drops so much for this group, and not for the other. One possibility is that the students who report that they are not better prepared for seminars than for lectures have lower academic abilities than the other group. The exercises the students are supposed to solve before going to seminars are typically perceived as challenging, and completion probably requires more effort than the preparation exercises do, especially for students who think the course is difficult. This is a possible explanation for why those who report *seminars* ≤ 0 also report below average preparations on Wednesday, and above average for Monday.

The coefficient on *reader* is negative and significant in all specifications. This is intuitive, since preferring to read rather than do exercises should imply that “traditional” preparations are relatively cheap, and the availability of preparation exercises should not increase the likelihood of preparing.

There is a negative and significant relationship between *extra* and *prepdiff*. This is intuitive,

since having done extra preparations for Wednesday obviously should make a student more prepared for Wednesday. However, the effect might be inflated by the mechanisms discussed for the coefficient on *prepalways*. If a student feels well prepared on Wednesday, he may be likely to ascribe that to having done extra preparations, simply because he is asked about it. Similarly, if poorly prepared for Wednesday, it might be an easy excuse to justify that by admitting that he did not do any extra preparations.

9 Concluding remarks

In this thesis I have studied academic procrastination, and tried to look at the phenomenon from various angles and approaches. In Part I, I start out reviewing the literature on the subject, from both an economic and psychological point of view. Since people who procrastinate typically view their own behavior as problematic and undesirable, traditional economic models of agents that always follow their best self-interest are regarded as insufficient for studying procrastination. Behavioral models, where the “self” is not necessarily constant over time, seems to not only better fit empirical data, but also to better fit our intuitive understanding of real-world human behavior. The most prominent models of this kind in the domain of procrastination are arguably the (β, δ) -models, developed by Ted O’Donoghue and Matthew Rabin. I move on to the psychological part of the literature, and find that there is a plethora of different personality traits that are related to procrastination. Newer research does, however, seem to emphasize the importance of timing of costs and rewards and how procrastinators discount future events, and in this regard, there is a convergence in economic and psychological research on procrastination. Steel and König (2006) provide (to my knowledge) the only attempt by psychologists to unify and formalize some of the many disparate psychological studies on the subject, but at this point, I cannot see how it contributes more to our understanding than the (β, δ) -models do.

In Part II, I discuss and analyze the results from two surveys performed on economics students at the University of Oslo. Procrastination is inherently difficult to study empirically, since all delay cannot be viewed as procrastination, while all procrastination is characterized by delay. Ultimately, only the agent himself can determine whether he is procrastinating or not. To further complicate the matter, asking subjects directly about their procrastinatory habits may be futile, if we take O’Donoghue and Rabin’s notion of naivete seriously. In addition, there might be psychological concerns that prevent truthful responses. For these reasons, I instead attempt to measure how well prepared the students are for the lectures where they are surveyed. For the first lecture, the students had the opportunity to complete some online preparation exercises, and the availability of these creates an incentive mechanism that may induce procrastinating students to prepare, while it will not affect the behavior of time consistent students much. I formally describe the decision process of the students using a (β, δ) -model, and find that the level of preparations is likely to be affected by both present bias and whether students are sophisticated or naive. And indeed, the reported levels of preparations are significantly higher for the lecture where the preparation exercises were available. With this in mind, I estimate a multiple regression model, with the difference in the levels of preparations between the two lectures where the surveys were held as the de-

pendent variable. As explanatory variables, I use the survey responses to various statements regarding the study habits and attitudes of the students, as well as some more standard, demographic variables. What I find, is that much of the variation in the preparation levels can be attributed to whether a student has a job or not (which in turn says something about how busy he is), which supports the idea that delay can come around for many reasons, and procrastination is just one of them. Several of the various measures of the student's attitudes towards teaching and studying show significant relationships with the dependent variable. In particular, students who report that they are usually well prepared for lectures and better prepared for lectures than for seminars seem to have benefitted the most from the availability of preparation exercises. Whether this in turn is related to present bias and procrastination is not clear, as the effect might stem from the possibility that these students value being prepared higher than others or they might differ in academic abilities. Those who report that they do not have good reasons for being unprepared also benefit from the preparation exercises, and this may be related to present bias. They imply that they sometimes prepare less than they want, so that for this group, the preparation exercises may have worked as a remedy for a self-control problem. I also find that the completion of preparation exercises has a positive effect on the score on a mandatory exercise. However, this result is not comparable to the survey data and is likely to suffer from considerable omitted variable bias, since I have not controlled for, e.g., ability and motivation.

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Appendix A. The surveys

Spørreundersøkelse – ECON2200

Denne undersøkelsen har som formål å kartlegge studievevaner, og er en del av en masteroppgave ved Økonomisk Institutt, UiO.

Undersøkelsen er anonym, men for analytiske formål ber vi deg om å skrive de fire siste sifrene i telefonnummeret ditt her: _____

Denne informasjonen vil kun bli brukt til å sammenligne resultater med en annen undersøkelse som vil bli utført på et senere tidspunkt.

I spørsmålsdelen nedenfor ber vi deg krysse av for det alternativet som passer best.

1. Har du en jobb ved siden av studiene?

- ☐ Ja, fulltidsjobb
- ☐ Ja, deltidsjobb
- ☐ Nei

2. Hvor mange emner tar du dette semesteret, i tillegg til ECON2200?

- ☐ Ingen
- ☐ 1
- ☐ 2
- ☐ 3 eller flere

3. Hvor gammel er du?

_____ år

4. Omtrent hvor mange timer i uken bruker du på studiene, ikke medregnet forelesninger og seminarer?

_____ timer

5. Har du gjort øvelsesoppgavene som er tilgjengelige på Fronter til denne forelesningen?

- ☐ Ja
- ☐ Nei

Her kommer noen påstander om dine studievevaner. Vennligst indiker med et kryss i hvilken grad du er enig eller uenig i påstandene.

Påstand	Helt enig	Delvis enig	Verken enig eller uenig	Delvis uenig	Helt uenig
Jeg er godt forberedt til dagens forelesning (Å være godt forberedt tilsier at du har en klar oversikt over hva som skal undervises, og over hva du eventuelt finner utfordrende med stoffet)					
Jeg er alltid godt forberedt til alle forelesninger i alle fag					
Dersom jeg ikke er godt forberedt, har jeg som regel en gyldig grunn til å ikke være det					
Jeg synes det er vanskelig å vite hva jeg skal gjøre for å forberede meg til en forelesning					
Jeg synes at å forberede seg til en forelesning er bortkastet, og jeg bruker heller tiden på å gå gjennom pensum fra tidligere forelesninger					
Jeg er som regel bedre forberedt til seminarer og lignende, enn til forelesninger					
Jeg synes det er mindre slitsomt å lese i lærebøkene enn å gjøre oppgaver tilknyttet pensum					

Spørreundersøkelse – ECON2200

Du trenger ikke å besvare denne undersøkelsen dersom du ikke var med på mandag.

Undersøkelsen er anonym, men for analytiske formål ber vi deg om å skrive de fire siste sifrene i telefonnummeret ditt her: _____

Denne informasjonen vil kun blir brukt til å sammenligne resultater fra den forrige undersøkelsen.

Denne undersøkelsen har som formål å kartlegge studievevaner, og er en del av en masteroppgave ved Økonomisk Institutt, UiO.

Her kommer noen påstander om dine studievevaner. Vennligst indiker med et kryss i hvilken grad du er enig eller uenig i påstandene.

Påstand	Helt enig	Delvis enig	Verken enig eller uenig	Delvis uenig	Helt uenig
Jeg er godt forberedt til dagens forelesning (Å være godt forberedt tilsier at du har en klar oversikt over hva som skal undervises, og over hva du eventuelt finner utfordrende med stoffet)					
Jeg skulle ønske at jeg vanligvis var bedre forberedt til forelesninger					
Jeg står som regel tidlig opp og jobber best tidlig på dagen					
Jeg har forberedt meg ekstra til dagens forelesning, siden det er en ny foreleser og lærebok					
Forpliktelser til venner og familie kommer ofte i veien for studiene mine					

